E U R O P E A N   S O U T H E R N   O B S E R V A T O R Y

Organisation Européenne pour des Recherches Astronomiques dans l'Hémisphère Austral

Europäische Organisation für astronomische Forschung in der südlichen Hemisphäre

ESO - LA SILLA

LA SILLA OBSERVATORY

F/35 Cassegrain Adapter and Top-Unit Hardware

Maintenance Manual

LSO-MAN-ESO-63108-0001

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INTERNAL USE ONLY

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1 INTRODUCTION

1.1 Purpose

This manual describes the setup of the control electronics of the F/35 Focus configuration on the 3.60m telescope. Its goal is to permit the repair and maintenance of its different modules. Installation and service procedures during an observing run are also detailed.

1.2 Scope

This document is aimed to the maintenance staff in charge to install and/or repair the different components of the F/35 configuration. The documents listed en 1.4 are still the basic source of information for some part of the hardware and in this document the emphasis is put on the new modules and the connections of the different sub-systems.

1.3 Applicable Documents

LSO-MAN-ESO-80100-0002 Issue 1.0 20/06/00 -- F/35 Adaptor and TCS Software User's Manual

1.4 Reference Documents

The following documents are referenced in this document.

[1] “Maintenance manual of the Mechanics and Optics of F/35 IR Top unit and F/35 IR Photometer/Adaptor for 3.6M Telescope" from J.L Lizon/A.van Dijsseldonk, ESO 1986

[2] "Maintenance manual for the F/35 Wobbling Mirror, Electronics and Servo System" from B. Jensen/J.M Moresmau, ESO 1985.

1.5 Abbreviations And Acronyms

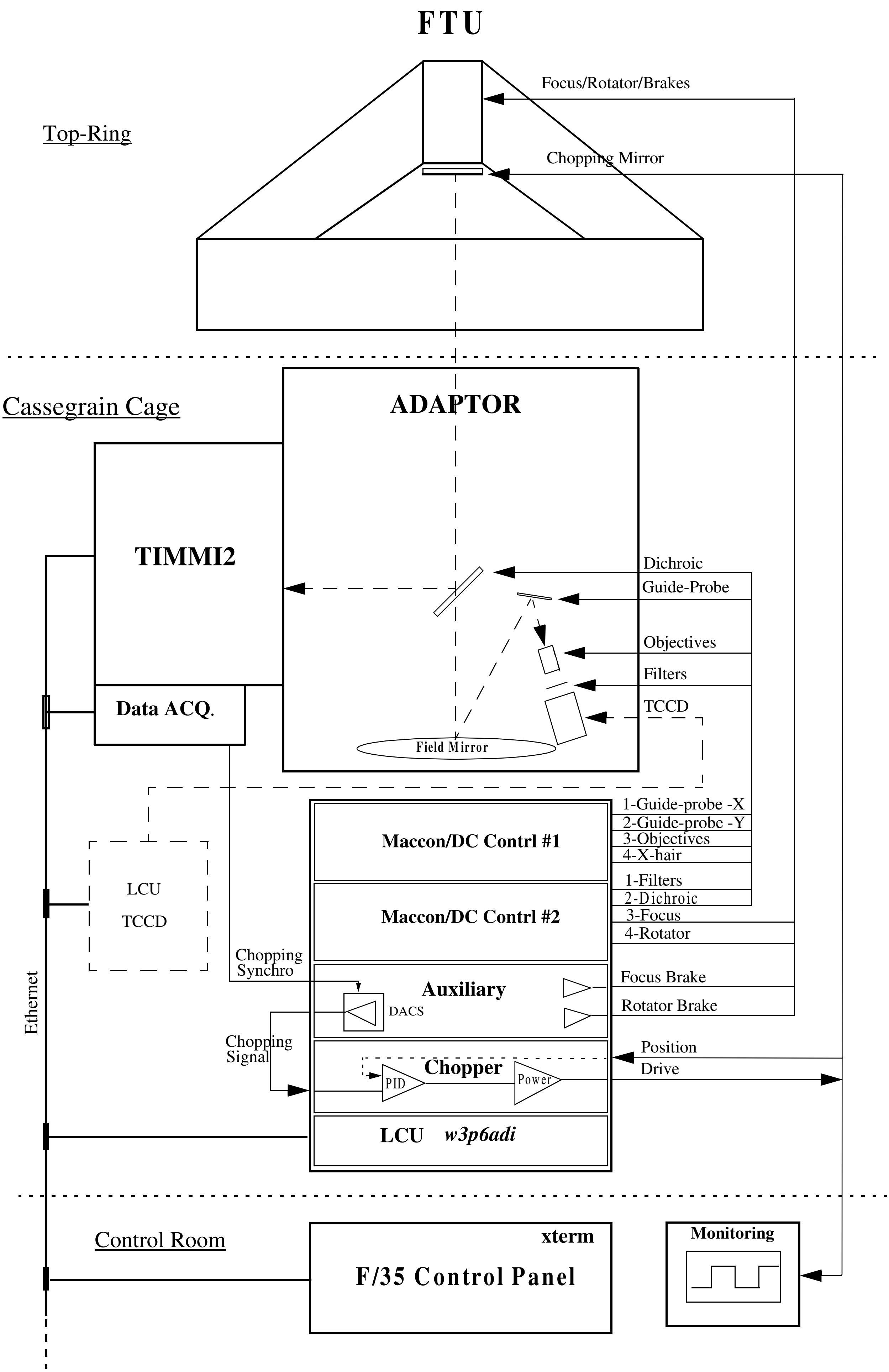
The following abbreviations and acronyms are used in this document::

FTU	Focusing and Turnig Unit
VME	
LCU	Local Control Unit
ACROMAG	Digital Input/Output Register from Acromag
TCS	Telecope Control Software
ICS	Instrument Control Software
TCCD	Technical CCD
I/O	Input/Output
GP	Guide-Probe
PID	Proportional Integral and Derivate
WS	Workstation

2 OVERVIEW

The F/35 configuration allows the use of a chopping secondary mirror for Infra-red observations with its own focusing and rotating features. These functions are proper of the so-called **FTU** (Focusing and Turning Unit) on the Top-ring, meanwhile at the Cassegrain focus the **IR Adaptor** permits some functions related with guiding as guide-probe motion, guiding camera, field width and detectors/instruments swapping.
The former control electronics based on CAMAC/NIM technology (1984) has been almost entirely refurbished to be hardware and software VLT compatible. Some components as the encoders have also been replaced with new types for unavailability reasons (discontinued) or for direct compatibility with the new control modules.
The mechanical and electronic modules are spread in 3 sub-systems: **Electronic Rack** and **IR Adaptor** both located in the Cassegrain cage and the **FTU**.

See for the specifications of the different function**s** and for a synoptics of their relations.


FTU
Top-Ring
Focus/Rotator/Brakes
Chopping Mirror
Cassegrain Cage
ADAPTOR
TIMMI2
Data ACQ.
Dichroic
Guide-Probe
Objectives
Filters
TCCD
Field Mirror
LCU
TCCD
1-Guide-probe -X
2-Guide-probe -Y
3-Objectives
4-X-hair
Maccon/DC Contrl #1
1-Filters
2-Dichroic
3-Focus
4-Rotator
Maccon/DC Contrl #2
Chopping
Synchro
Auxiliary
DACS
Focus Brake
Rotator Brake
Chopping
Signal
Chopper
PID
Power
Position
Drive
LCU w3p6adi
Ethernet
Control Room
xterm
F/35 Control Panel
Monitoring

3 CASSEGRAIN ADAPTOR

The IR Adaptor shelters 7 functions :X and Y Guide-probe motion, the TCCD guiding camera, with its filters wheel, a pair of swapable field lenses, a pair of diverting dichroic mirrors and an electronic Cross-hair. Each function is an independant mechanical/electronic set which can be removed for lab tests. A local interface box provides the buffering and power needed for the long connections to the main rack. A set of test cables permits a direct connection to the VME modules in the lab configuration.
See **Chapter 8.1** for details of connections with the LCU.

3.1 Guide-Probe

In front of the TCCD a small flat mirror with two-axes rotation and a central hole can scan the field mirror and allows for the exploration of the sky and autoguiding features. As these 2 movements go through motor rotation, worm/nut translations, and lever arms they lead to a non-linear relationship beetween the encoders and the mirror tilting. So a precise scale mapping of the field is necessary.
The incremental encoders (250 pulse/rev) runs for ~ 32 turns beetwen the hardware limits of the worm/nuts which gives 8000 pulses for a total field of 9.6' , i.e an angular resolution ~ 0.07" at the center.
The reference positions are given by the first zero pulse of the encoders after coming back from the upper hardware limit at initialisation. See Ref. Document [1] Chapt. B 1.2.3

3.2 Filters Wheel

In front of the TCCD a wheel bearing 8 filters is driven by the motor/encoder set through a factor 8 reduction which gives 2000 pulse/rev and a resolution of ~ 0.2 ° on the filter position.
The reference position is given by a magnetic sensor which detects a hole in the metalic wheel again synchronized with the zero pulse of the encoder. See ref. Document [1] Chapt. B 1.2.4

3.3 Dichroic Mirror

Three basic positions for this rotating set of 2 mirrors: a central one where no mirror intercepts the light beam to permit a non-attenuated view of faint sources, and two end positions where the beam is diverted to one of two detector. The central position (Dichroic OFF) is referenced through an absolute 8 bit encoder meanwhile the 2 end positions are fixed hardware limits. The motor drives the rotating set through a slipping clutch and a bistable spring assembly. This configuration ensures that a permanent mechanical force maintains the mobile part on the hardware limit when the motor is OFF.
Another critical condition is the good balance of the rotating part. See the counterweight trimming.

3.4 Objectives Changer

A similar assembly is used but in a linear configuration. There is no encoder as only 2 mechanical end-positions are used. The small field has its own manual focus trimming.

3.5 X-Hair

The TCCD looks to the X-hair assembly through a small center hole in the GP mirror. The controller amplifier regulates the current of an incandescent bulb located behind a tiny wire cross. The cross stray light moves over the sky field and is a fixed reference on the camera/chip field.

3.6 Tecnical CCD

The xxxx X xxxx CCD camera head is housed in the Cass IR Adaptor and comes almost in contact of the filter wheel. Power and coolant are taken from available outlets on the telescope Cassegrain rotator and the CCD head is connected to the support electronics of the Rotator own Center Field Camera.

4 TOP-RING UNIT

The Focusing and Turning Unit is under control of channels 3 and 4 of the Maccon controller nbr. 2. The chopping unit is mounted under the lower flange of the FTU and is electrically independant from it .
The focus and rotating axis are blocked in the no-energized state by mechanicals built-in brakes. For safety reason these 2 functions are hardware interlocked with their respective brake to protect them against any software glitch or manual mishandling : part of the current through the brake coil is used to power the hardware limit circuit; hence when the coil is not activated both end limits signals are in the "limit reached" state and inhibit the output amplifiers. In local mode 2 switches permit the manual release of the brakes and the control of the axis with the handset. These functions are implemented on the Auxiliary board. (see **Chapter 8.2 & 8.3**).

4.1 Focus

An encoder of 250 puls/rev and a 5.5 revs (= 5.5 mm translation) full range give a resolution of ~ 4.0 micron/pulse. The (velocity) servo-loop is of the proportional/integral type as the output circuit is open when the axe is braked (The former design maintened the motor under control even with the axe blocked and would have then developped full ouput voltage with an integral correction).
See Chap 2.1.2 in "Wobbling Mirror Maintenance manual " ESO 1985).

4.2 Rotator

The mid-range position was selected as to permit a East-West direction chopping and with a full range of ~ 205 ° (950 encoder pulses) we can explore over 90 ° on both sides.
Scale: 1 pulse => 0.22 ° or 1 ° => 4.63 pulses .
Due to the lack of space there was no Tacho generator installed in the original design and the control was implemented through an open loop. Now a derivative correction is implemented in the Maccon controller software which allows for a larger proportional gain, better accuracy and a smoother rotation.

4.3 Chopper

The control of the M2 chopping mirror still use the same servo-control board in its dedicated small rack. The analog control loop with PID correction has 2 inputs, one of which is feeded by the Chopper Offset function from the Auxiliary Board.That function uses 2 DACs and an analog switch. From the parameters given by the observer (On Star Position and Chopping Amplitude), the software computes the respective values for the 2 extreme positions of the mirror and loads them into the DACs. Then a 2 to 1 analog switch selects the signal. The selection is controlled by 2 logically ANDED signals: bit 1 P(6) from Acromag for software convenience and a TTL input for an external signal (when the detector actually needs to master the chopping).
See **Chapter 8.2**

5 SETUP AND OPERATION

5.1 Setup

During an instrument change-over, the different parts shall be installed in the following order:

1. The Main Electronic Rack on its dedicated stand with front door towards the center of the cage.
2. The Cassegrain Adaptor on the focal instrument flange.
3. Exchange of the Top-Ring Units (F/8 <-> F/35).
4. With the Telescope to the Platform, connections of the Top-Ring cables (4 connectors) and removal of the Chopper mirror (M2) cover.
5. In the cage, the main cable beetween the Cass Adaptor and the Main Electronic Rack (Burndy 104 pin)
6. Connections from the Top-Ring to the Main Rack (behind and through the floor aperture)

   As space is limited, these connections require to **momentarily** move ~ 15 cm forwards both Power Amps and Servo racks):

   - On Power Amps Rack:
     - Mirrors Drives (1x Souriau, “domino” type, labelled **MU**)
     - 2x 220v plugs from Servo rack (220v power is under control of a solid-state switch)
   - On Servo rack:
     - Position Sensor (1x Lemo 6 pins, labelled **PM**)
     - Mirror Ends Stops (Burndy 19 pins, labelled **E**)
   - From LCU terminals:
     - Focus and Rotator encoders (Burndy 23 & 19 pins respectively, labelled **F** & **R**)
     - Foc/Rot Motors/Brake/Limits (Burndy 19 pins, labelled **M**, DO NOT confuse with Mirror Ends Stops)

   Chapter 8.4 gives a synoptic view of the Top-ring cabling

7. Ethernet connection on the Main Rack
8. Power connections on Main Rack and Cass Adaptor.
9. Power and Signal connections of the TCCD from the available modules on the Cassegrain Rotator.
10. A Position Signal is available on a BNC connector of the Chopper Servo-loop module to be monitored in the control room.

5.2 Operation

At power-up on both the Cass Adaptor and the LCU in the Main Rack, nothing happens as the system is in local (Manual) mode. Meanwhile, the CPU loads the application from a Server (~ 2 min) before to be able to respond to control from the User Interface in the corresponding workstation. Once the User Interface takes control, no local action is possible (from the handset) unless the CPU is hardware reset.

5.3 Testing in local mode

To test the integrity of the different functions without the need of a workstation and the net, one can use the direct analog handset feature designed in the DC Motor Drive modules. One can select the direction and speed of the movement on one axis/function at a time and check the result with the status

Leds (Upper and Lower Limits, Zero pulse, ...
For the 2 FTU functions, a pair of small switches on the front plate of the Auxiliary module permit to release any of the corresponding brake before any movement on these axis.

6 FTU Disassembly

(**# xx** refers to items in Drawing T 45-102 f 1/2 02)
Making some tools as (I 31.300-07 + 08 + 09) to remove the Transroll nuts.

6.1 Installation in Test Stand

- Set-up to materialize/measure the center of rotation relative to spider arms before dismounting.
- Install hook on top of FTU
- Ease-out or remove the 4 x M6 push-pull screws and release the 4 clamps :
    a. "fastening body" (I 31.300.02) to free up the FTU from the Top-Ring
    b. cylinder (see F/35 Maintenance Manual chap.A.1.1.6 page 13).
- Ease out smoothly the FTU with the crane.
- Install it in the Test Stand.
- Clamp it w/ (I 31.300.02).

6.2 Removing the Rotator Encoder

- Free-up the cables/connectors from the Top Flange
- To free-up the supporting steel spiral set: (T45-102-68 & 69), unscrew the (T45-102-68) fix point axle to loose it from the T45-102-07 support, and un-roll steel spiral and cables.
- Remove the 6 M6 screws #44, and then the top flange I 31-300-01.
- Remove the 4 spring washers, ring #10 and Tap #04
- Ease out the assembly of (#02 + ball-bearings set + #07 + Magnet Brake) along the #05 cylinder.
- Put back Tap #04 on #05 cylinder.
- Extract #07 from the assembly as it has to be machined to accept Heidenhaim encoders in replacement of the Litton's.

6.3 Removing the Focus Encoder

- Now the 6x M6 long screws (T45-102-47) can be accessed and dismounted:

  this will free the "Electro-mechanical Focussing part" from the "Mechanical Rotator and Focusing part". Then the Electro-mechanical part can be removed holding it by the counterweight and lifting it smootly while taking care of the cables.

  CAUTION: Do not apply force on the focussing screw or any part still attached to it!

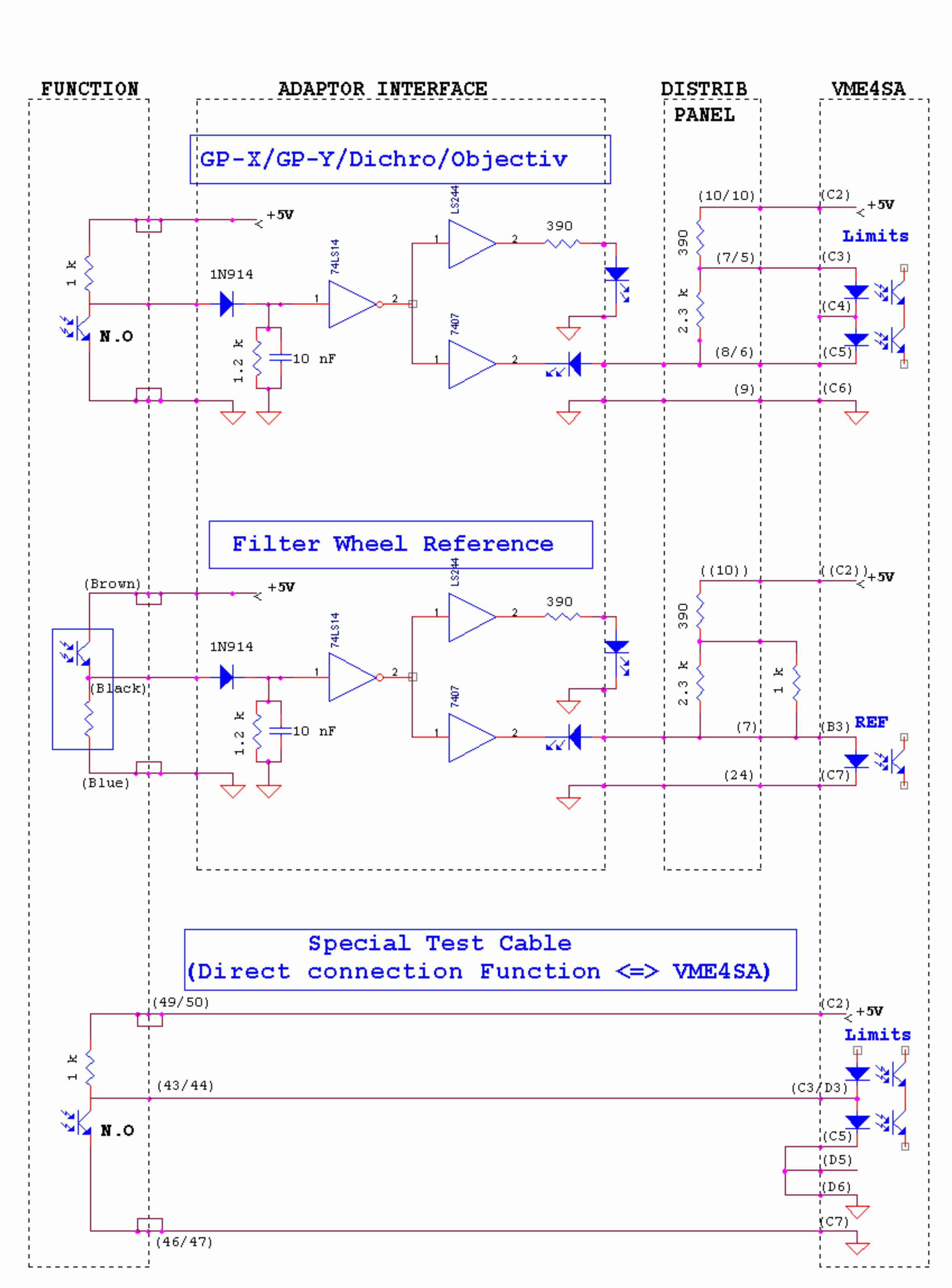
7 FUNCTIONS SPECIFICATIONS

Table 1: Functions Specifications

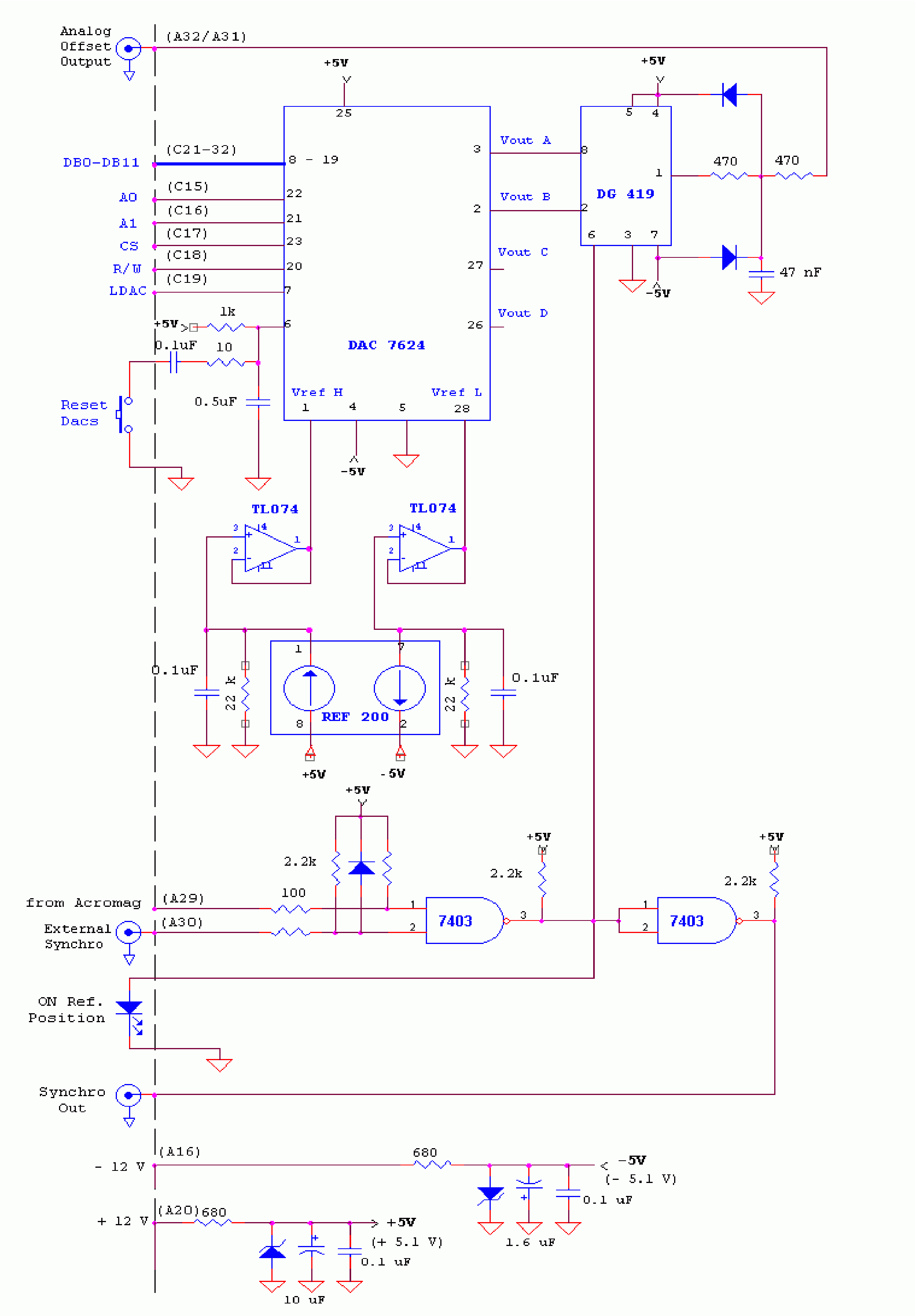
	Axis Type	Clutch/ Brake	HW Limit	Encoder	Motor/Tacho	Remark	Init. System	Acromag Mapping	Maccon Nr/Ch
X-Field GP	linear, field: 9,6’ scale: 1,64 “/mm		Upper & Lower	Heidenhain, inc. ROD 1020, 250 pls	Escap 28L28-416E Escap 28C24-405	velocity loop PID	Upper HWLim + Zero Pulse		1/1
Y-Field GP	idem X-Field		idem	idem	idem	idem	idem		1/2
Objective Changer	linear, 2 posititions	slipping clutch	Upper & Lower	none	Escap 28L28-410E Escap 16C24-204	2 mech end-stops	Upper HWLim		1/3
X-Hair			0 - 24 V	none	Incandescent Bulb				1/4
Filter Wheel	rot. infinite Range 8 pos./2000 pls			Heidenhain, incremental ROD 1020, 250 pls	Escap 28L28-410E Escap 16C24-204	velocity loop PID	Ref. Pulse + Zero Pulse		2/1
Dichroic Mirror	linear, 3 posit.	slipping clutch	Upper & Lower	Litton, 8bit binary SNB11-09P11	Escap 28L28-410E Escap 16C24-204	2 end-stops + 1 enc pos.	Upper HWLim		2/2
Focus	linear Range 5 mm resol: 3,65 µm	Brake 24V/ 0,3A	Upper & Lower	Heidenhain, inc. ROD 1020, 250 pls	Inland NT 2146 Inland TG 2126	velocity loop PD	Upper HWLim + Zero pulse	Brake: P(7,6) Status: P(6,7)	2/3
Rotator	rot. Range 205 deg. resol:. 0.22 deg.	Brake 24V/ 2A	Upper & Lower	Heidenhain, inc ROD 1020, 250 pls	Escap 28PL21-419E No Tacho	open loop high gear ratio	Upper HW lim + Zero pulse	Brake: P(7,5) Status: P(6,6)	2/4
Chopper Offset	Sky scale: 36”/V Pk to Pk: 2’30”		+/- 2,15 V		Burr-Brown DAC7624 (4x 12 bit DAC)		Power-On Reset: V=0.0V	DAC: P(2,4) Ctrl: P(7,0-4) Switch:P(6,1)	n.a.
Chopper Power							OFF State	P(7,7)	n.a.

8 SCHEMATICS

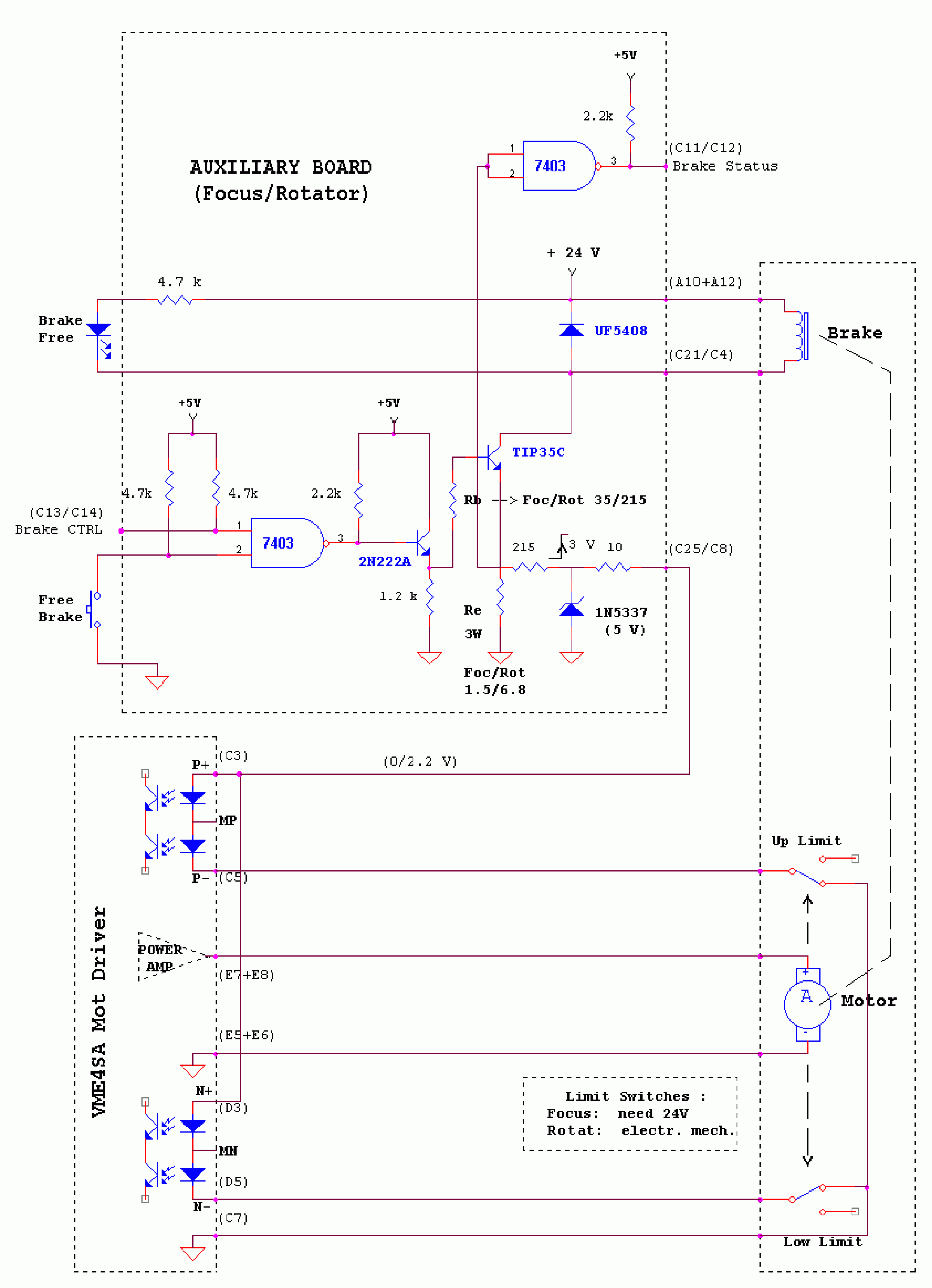
8.1 Adaptor Interface Connections



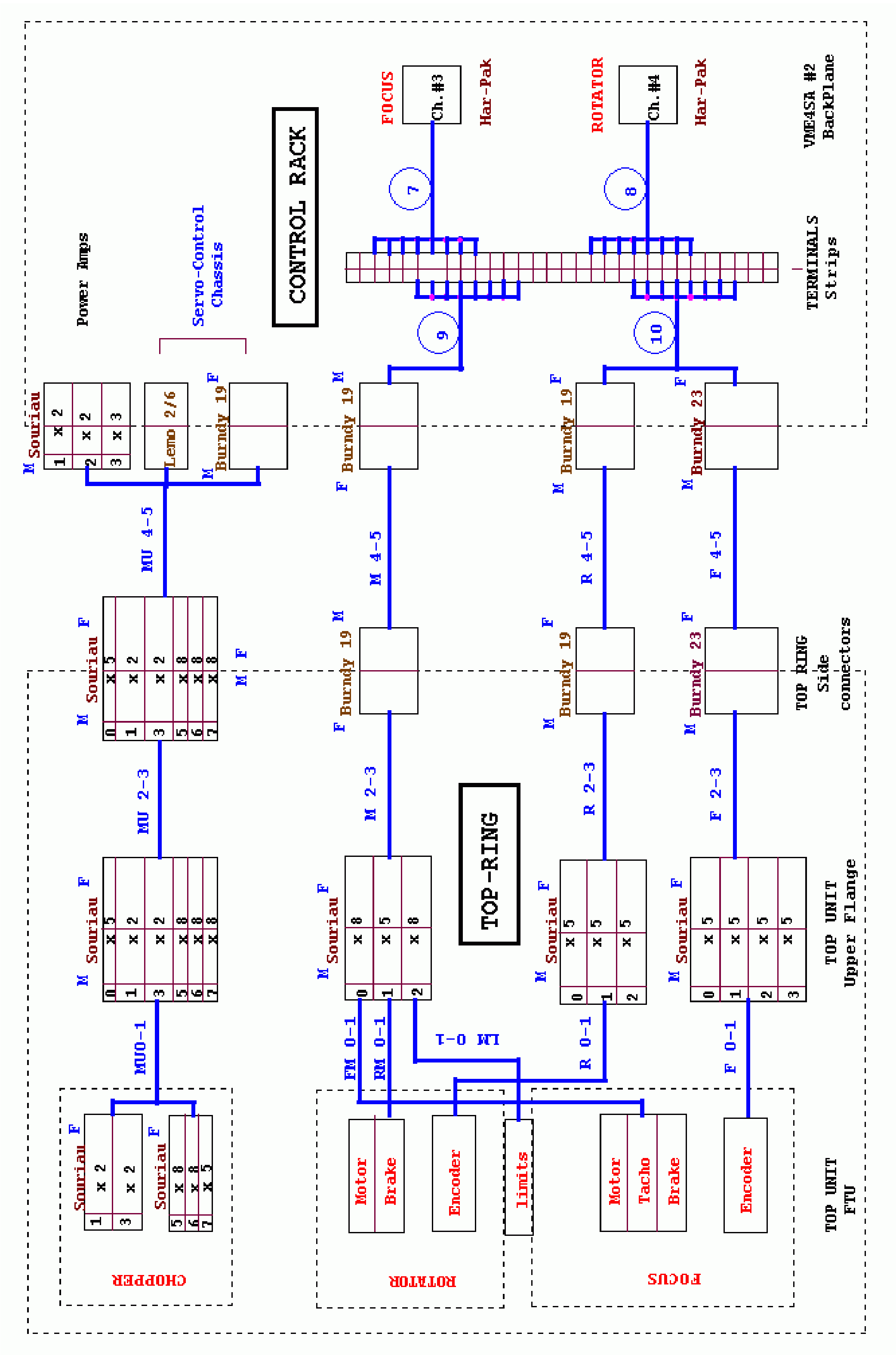
8.2 Chopper Offset Control



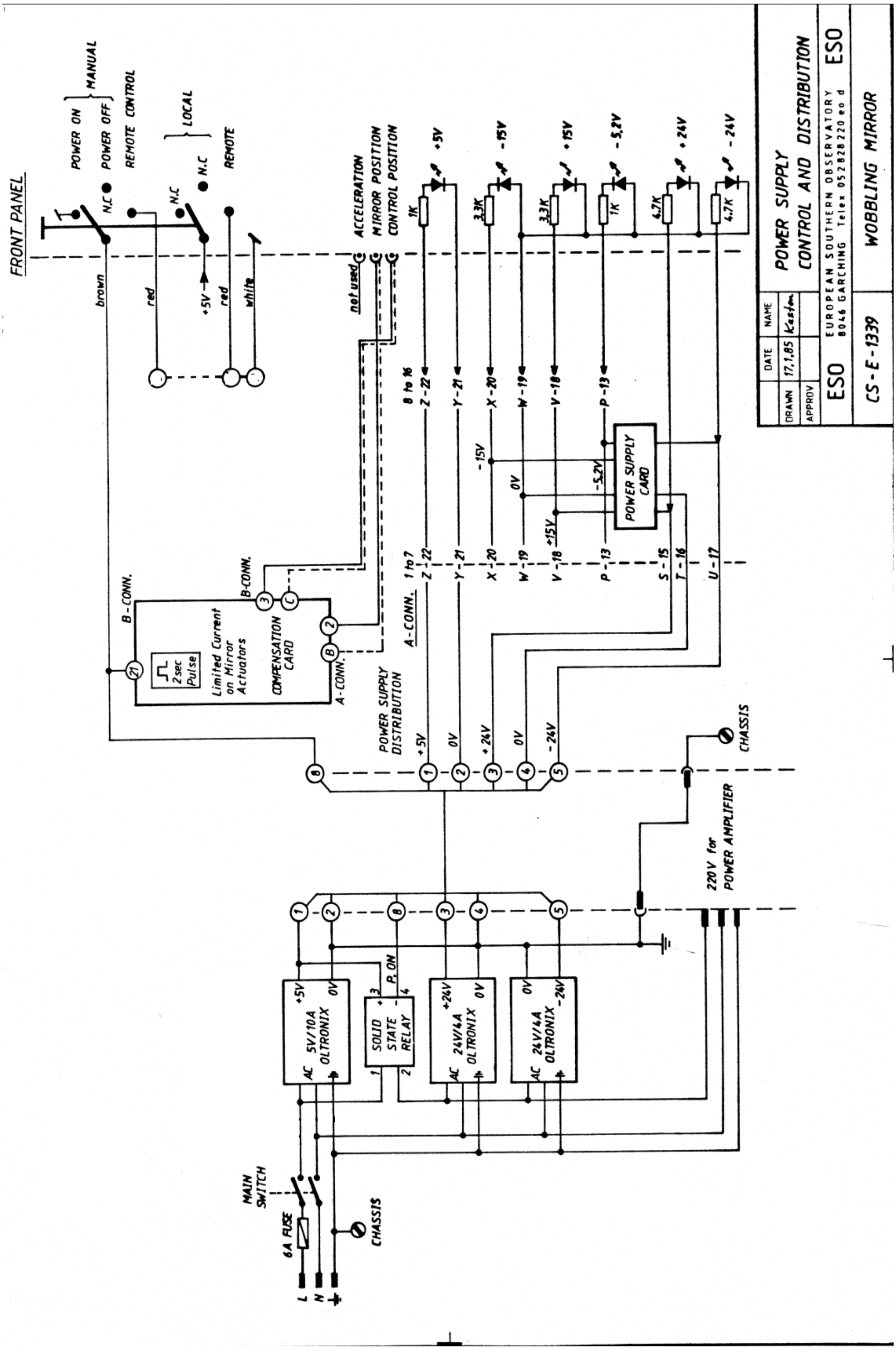
8.3 FTU Brakes Function



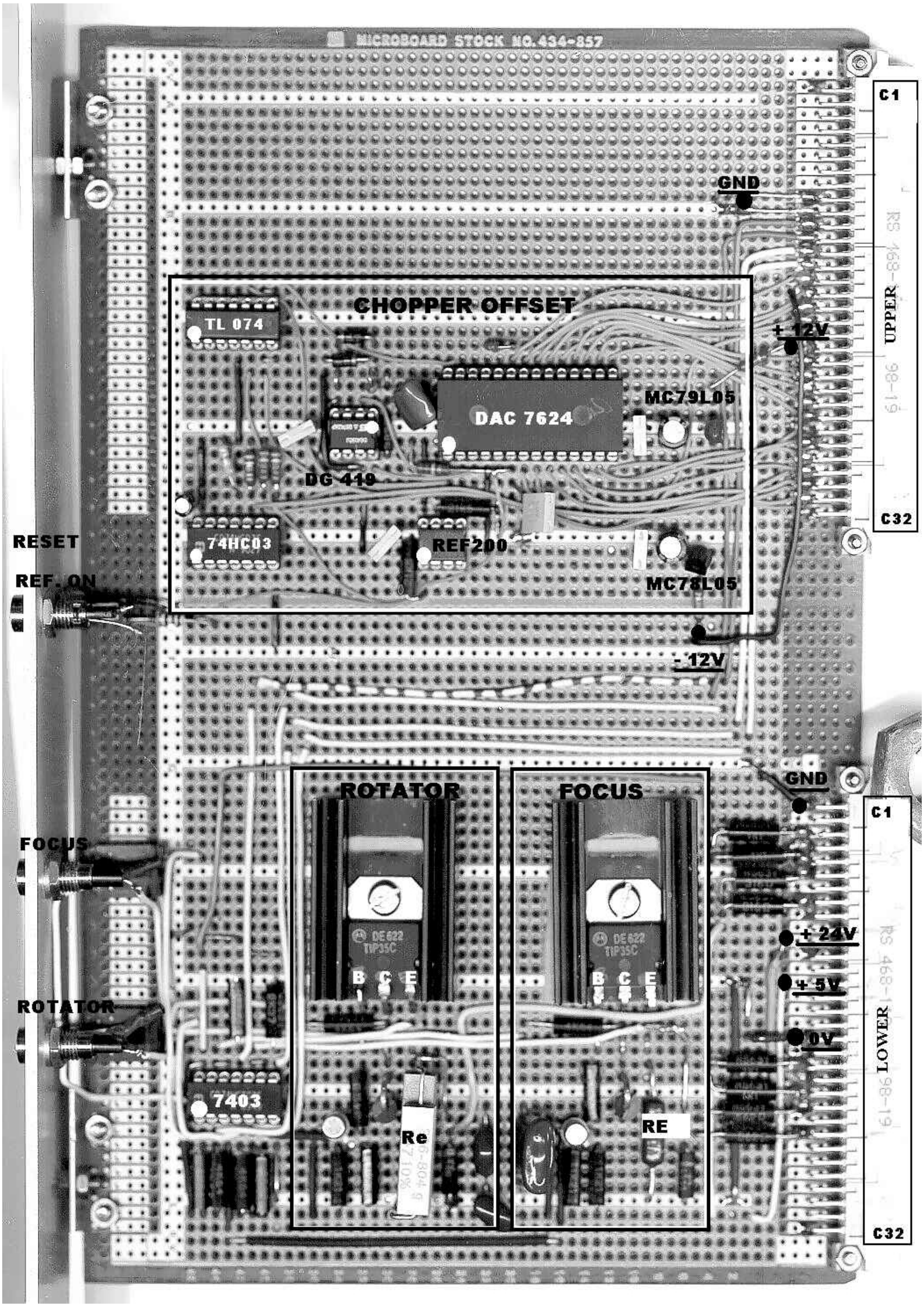
8.4 FTU to LCU Cabling



8.5 Servo Rack Internal Wiring



8.6 Auxiliary Module Components Location



9 MAPPING OF ACROMAG PORT P2

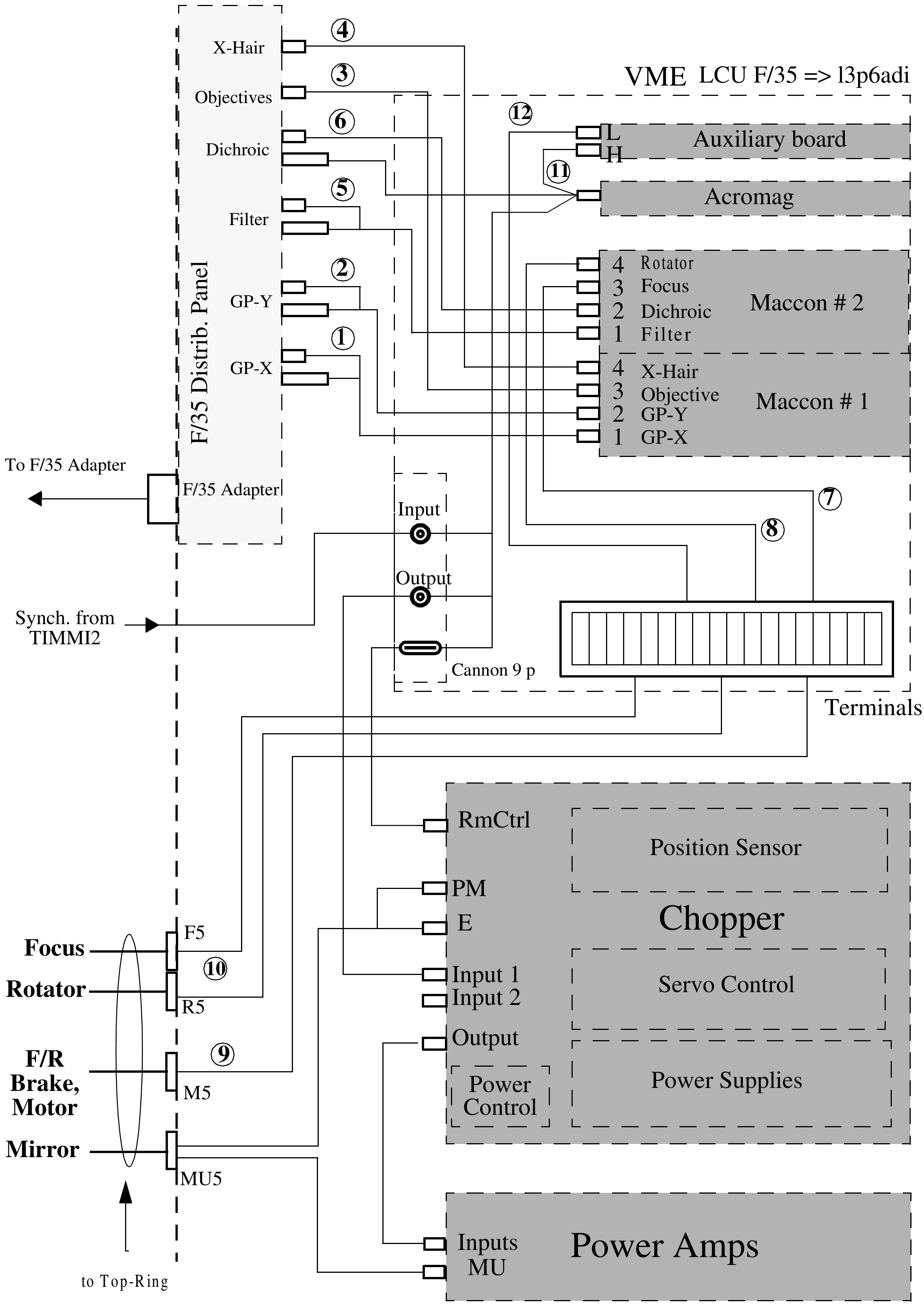
	Port/Pin	**Function**	**Connector P2**	**Inducer bit**	**Default Status**
Control bits	Port(7) pin (7)	Chopper Power ON	A16	63	1 => Power OFF
	Port(7) pin (6)	Focus Brake ON/OFF	A15	62	1 => Axe locked Brake ON
	Port(7) pin (5)	Rotator Brake ON/OFF	A14	61	idem Focus
	Port(7) pin (4)	Chopper DAC A0	A13	60	
	Port(7) pin (3)	Chopper DAC A1	A12	59	
	Port(7) pin (2)	Chopper DAC CS	A11	58	
	Port(7) pin (1)	Chopper DAC R/W	A10	57	
	Port(7) pin (0)	Chopper DAC LDAC	A9	56	1 => Registers latched
	Port(6) pin (7)	Focus Brake Status	A8	55	1 => Axe locked
	Port(6) pin (6)	Rotator Brake Status	A7	54	idem Focus
	Port(6) pin (5)	reserved	A6	53	
	Port(6) pin (4)	res.	A5	52	
	Port(6) pin (3)	res.	A4	51	
	Port(6) pin (2)	res.	A3	50	
	Port(6) pin (1)	Chopper Posit. Control	A2	49	1 => DAC B, Ref. Posit. 0 => DAC A Offset Posit.
Dichroic	Port(6) pin (0)	Encoder bit 8	A1	48	
	Port(5) pin 0 to 7	Encoder bit 0 to 7	C24-C17	40-47	
Chopper Bus	~~Port(4) pin 4 to 7~~	not used		~~36-39~~	
	Port(4) pin 0 to 3	DAC bit 8 to 11	C32-C29	32-35	
	Port(3) pin 0 to 7	DAC bit 0 to 7	A24-A17	24-31	
	~~Port(2) pin 0 to 7~~	not used	~~A32-A25~~	~~16-23~~	
	~~Port(1) pin 0 to 7~~	not used	~~B24-B17~~	~~8-15~~	
	~~Port(0) pin 0 to 7~~	not used	~~B32-B25~~	~~0-7~~	
	+ 5 V	pins C1,C9,B1,B9	<=		
	GND	pins C5-C8, C13-C16	<=		
		pins B5-B8, B13-B16	<=		

LCU: VME Slots Configuration

Slot	Module	Function
1/2	IF MVME 712M	Interface Connection Card
3	CPU 167-01A	CPU
5	Maccon MAC4-INC #1	Motor Controller for Guide Probe, Objective, Crosshair
6	VME4SA #1	Amplifier
9	Maccon MAC4-INC #2	Motor Controller for Filter, Dichroic, Focus, Rotator
10	VME4SA #2	Amplifier
12	DIG I/O (Acromag)	Digitial I/O
13/14	Auxiliary Board	DAC for Chopper Control, Focus/Rotator Brake Control
16/17	Power Supply +/- 15v, 5V	

10 CABLING OF THE MAIN RACK

10.1 Synoptics



10.2 Cabling of Main Rack

Table 2: List of cables in Main Rack

No	Name	From	connector	Lenght	Nbr of pins	To	connector	Comments
1	**GP-X**	Maccon 1, Ch 1	Har-Pak	0,80 m	3+3+7+7	Distrib Panel	Canon D 15M & Canon D 25M	
2	**GP-Y**	Maccon 1, Ch 2	Har-Pak	0,80 m	3+3+7+7	Distrib Panel	Canon D 15M & Canon D 25M	
3	**Objectives**	Maccon 1, Ch 3	Har-Pak	0,80 m	3+7+7	Distrib Panel	Canon D 15M	
4	**X-Hair**	Maccon 1, Ch 4	Har-Pak	0,80 m	3+7+7	Distrib Panel	Canon D 15M	
5	**FilterWheel**	Maccon 2, Ch 1	Har-Pak	0,80 m	3+3+7+9	Distrib Panel	Canon D 15M & Canon D 25M	
6	**Dichroic**	Maccon 2, Ch 2	Har-Pak	0,80 m	3+3+7	Distrib Panel	Canon D 15M & Canon D 25M	
7	**Focus Ctrl to Terminals**	Maccon 2, Ch 3	Har-Pak	0,15 m	3+3+9+7	Terminals		
8	**Rotator Ctrl to Terminals**	Maccon 2, Ch 4	Har-Pak	0,15 m	3+3+9+7	Terminals		
9	**Foc/Rot Ctrl to Top-Ring**	Terminals		0,80 m	17		Burndy 19M	Motors/Brakes/Limits
10	**Foc/Rot Enc to TopRing**	Terminals		0,80 m	10+10		Burndy 23F & Burndy 19F	Focus Encoder & Rotator Encoder
11	**Acromag**	Acromag P2	DIN 41612	0,15 m	27	Auxiliary board	Upper DIN 41612	Chopper Posit. DAC
				0,10 m	6	LCU BackPlate	Canon D 9F	Chopper Power Ctrl
12	**Auxiliary**	Auxiliary Lower	DIN 41612	0,20 m	23	Terminals		Foc/Rot Brakes
				0,10 m	2	LCU BackPlate	2x isolated BNC	Analog Signal for Chopper position & Extern Swap Ctrl

10.3 Details of Cables

NAME	1, 2 : Guide-Probe X Y	PROJECT	F/35 Upgrade
DATE	27 Feb 99		
Connector	asmbly of shielded	LENGHT	0.80m
FROM	VME backPlane Maccon #1	TO	F/35 Distribution Panel
PLUG	Har-Pak (Harting)	PLUG	Cannon D (15 & 25 pins) Males

SIGNAL	FROM pin		TO pin	WIRE COLOR or NUMBER	COMMENTS
M+	E7,E8		3	Brown	Cannon D 15 pin, Male
M-	E5,E6		4	White	id
Shield	D7		14	Shield	id
T+	E3		1	Brown	id
T-	E2		2	White	id
Shield	E4		15	Shield	id
ULim+	C3		7	Yellow	id
ULim-	C5		8	Green	id
LLim+	D3		5	Pink	id
LLim-	D5		6	Gray	id
+5 V	C2		10	Red+Blue	id
GND	C7		9	Brown+White	id
Shield	C6				
A+	A8		1	Red	Cannon D 25 pin , Male
A-	A6		2	Blue	id
B+	B7		3	Brown	id
B-	B5		4	White	id
Z+	A4		5	Pink	id
Z-	A2		6	Gray	id
Shield	C6		15	Shied	id
Tags:					Tags:
PG-X Macc #1, Ch.1					GuideProbe X
PG-Y Macc #1, Ch.2					GuideProbe Y

NAME	**3, 4: Objective, X-Hair**	PROJECT	F/35 Upgrade
DATE	14 Nov 99		
Connector	asmbly of shielded	LENGHT	0.80m
FROM	VME backPlane Maccon #1, Ch. 3&4	TO	F/35 Distribution Panel
PLUG	Har-Pak (Harting)	PLUG	Cannon D 15 pin Male

SIGNAL	FROM pin		TO pin	WIRE COLOR or NUMBER	COMMENTS
M+	E7,E8		3	Brown	Cannon D 15 pin, Male
M-	E5,E6		4	White	id
Shield	D7		14	Shield	id
T+	E3		1	Brown	id
T-	E2		2	White	id
Shield	E4		15	Shield	id
ULim+	C3		7	Yellow	id
ULim-	C5		8	Green	id
LLim+	D3		5	Pink	id
LLim-	D5		6	Gray	id
+5 V	C2		10	Red+Blue	id
GND	C7		9	Brown+White	id
Shield					
Tags:					Tags:
Objectives, Macc #1, Ch.3					Objectives
X-Hair, Macc #1, Ch.4					X-Hair

NAME	5: Filters Wheel	PROJECT	F/35 Upgrade
DATE	25 Nov 99		
Connector	asmbly of shielded	LENGHT	0.80m
FROM	VME backPlane Maccon #2, Ch.1	TO	F/35 Distribution Panel
PLUG	Har-Pak (Harting)	PLUG	Cannon D (15 & 25 pins) Males

SIGNAL	FROM pin		TO pin	WIRE COLOR or NUMBER	COMMENTS
M+	E7,E8		3	Brown	Cannon D 15 pin, Male
M-	E5,E6		4	White	id
Shield	D7		14	Shield	id
T+	E3		1	Brown	id
T-	E2		2	White	id
Shield	E4		15	Shield	id
ULim+	C3		7	Yellow	id
ULim-	C5		8	Green	id
LLim+	D3		5	Pink	id
LLim-	D5		6	Gray	id
+5 V	C2		10	Red+Blue	id
GND	C7		9	Brown+White	id
Shield	C6				
A+	A8		1	Red	Cannon D 25 pin , Male
A-	A6		2	Blue	id
B+	B7		3	Brown	id
B-	B5		4	White	id
Z+	A4		5	Pink	id
Z-	A2		6	Gray	id
Ref. Position	B3		7	Yellow	id
GND	C7		24	Green	id
Shield	C6		15	Shield	id
Tags:					Tags:
FILTERS Macc #2, Ch.1					Filters

NAME	6: DICHR. MIRROR	PROJECT	F/35 Upgrade
DATE	18 JAN 2000		
Connector	asmbly of shielded	LENGHT	0.80m
FROM	VME backPlane Maccon #2, Ch.2	TO	F/35 Distribution Panel
PLUG	Har-Pak (Harting), DIN 41612	PLUG	Cannon D (15 & 25 pins) Males

SIGNAL	FROM pin		TO pin	WIRE COLOR or NUMBER	COMMENTS
HAR-PAK					
M+	E7,E8		3	Brown	Cannon D 15 pin, Male
M-	E5,E6		4	White	id
Shield	D7		14	Shield	id
T+	E3		1	Brown	id
T-	E2		2	White	id
Shield	E4		15	Shield	id
ULim+	C3		7	Yellow	id
ULim-	C5		8	Green	id
LLim+	D3		5	Pink	id
LLim-	D5		6	Gray	id
+5 V	C2		10	Red+Blue	id
GND	C7		9	Brown+White	id
Shield	C6				
ACROMAG P2					Cannon D 25 pin , Male
Encoder D8	A1		9		through a 10 pins flat cable & connect.
D7	C17		8		id
D6	C18		7		id
D5	C19		6		id
D4	C20		5		id
D3	C21		4		id
D2	C22		3		id
D1	C23		2		id
D0	C24		1		id
GND	C15		10		id
Tags:					Tags:
Dichroic, Mac #2,Ch.2					

NAME	7: Focus Ctrl - Terms.	PROJECT	F/35 Upgrade
DATE	24 NOV 99		
Connector	asmbly of shielded	LENGHT	0.15 m
FROM	VME backPlane Maccon #2, Ch.3	TO	Back Terminals Strips
PLUG	Har-Pak (Harting)	PLUG	Terminals

SIGNAL	FROM pin		TO pin	WIRE COLOR or NUMBER	COMMENTS
M +	E7,E8			Brown	
M -	E5,E6			White	
Shield	D7			Green-Blue	
					Block D
T +	E3			Brown	
T -	E2			White	
Shield	E4			Green-Blue	
~~(Handset Input)~~	~~B6~~			~~White~~	Not Used
ULim+ (P +)	C3			Brown	
(MP)	C4			Red	
ULim- (P -)	C5			Blue	Block A B
LLim+ (N +)	D3			Gray	
(MN)	D4			Pink	
LLim- (N -)	D5			Yellow	
GND	C7			Green	
Shield	C7			Green-Blue	
A +	A8			Red	
A -	A6			Blue	
B +	B7			Brown	
B -	B5			White	
Z +	A4			Pink	Block G
Z -	A2			Gray	
+ 5 V	C2			Yellow	
GND	C6			Green	
Shield	C6			Green-Blue	
					Servo Parameters:
					R1 (TG) R2 (P) C1 (I) D
					2.7K 100K 0.25UF 0UF

NAME	**8: Rotator Ctrl - Terms.**	PROJECT	F/35 Upgrade
DATE	24 NOV 99		
Connector	asmbly of shielded	LENGHT	0.15 m
FROM	VME backPlane Maccon #2, Ch.4	TO	Back Terminals Strips
PLUG	Har-Pak (Harting)	PLUG	Terminals

SIGNAL	FROM pin		TO pin	WIRE COLOR or NUMBER	COMMENTS
M +	E7,E8			Brown	
M -	E5,E6			White	
Shield	D7			Green-Blue	
					Block F E
T +	E3			Brown	
T -	E2			White	
Shield	E4			Green-Blue	
~~(Handset Input)~~	~~B6~~			~~White~~	Not Used
ULim+ (P +)	C3			Brown	
(MP)	C4			Red	
ULim- (P -)	C5			Blue	Block A B
LLim+ (N +)	D3			Gray	
(MN)	D4			Pink	
LLim- (N -)	D5			Yellow	
GND	C7			Green	
Shield	C7			Green-Blue	
A +	A8			Red	
A -	A6			Blue	
B +	B7			Brown	
B -	B5			White	
Z +	A4			Pink	Block H
Z -	A2			Gray	
+ 5 V	C2			Yellow	
GND	C6			Green	
Shield	C6			Green-Blue	
					Servo Parameters:
					R1 (TG) R2 (P) C1 (I) D
					infini 20K inf (CC) 0UF

NAME	**9: Foc/Rot Ctrl - Topring**	PROJECT	**F/35 Upgrade**
DATE	**14 NOV 99**		
Connector	**asmbly of shielded**	LENGHT	**0.80 m**
FROM		TO	**Back Terminals Strips**
PLUG	**Burndy 19 pin Male Chassis**	PLUG	**Terminals**

SIGNAL	FROM pin		TO pin	WIRE COLOR or NUMBER	COMMENTS
FOCUS M +	V/1			Red	
“ M -	P/2			Blue	
					Block D
“ T +	J/16			Violet	
“ T -	K/17			Black	
“ Brake	U/6			Red-Blue	Block C
“ ULim	N/7			Gray	
“ LLim	A/8			Pink	Block A B
Lim 0 V	C/10			Grey-Pink	
ROTATOR M+	S/4			Yellow	
“ M -	R/3			Green	
					Block F
“ T +	L/18			Brown	(not used)
“ T -	M/19			White	(not used)
“ Brake	B/9			White-Yellow	Block C
“ ULim	E/12			Brown-Green	Block A B
“ LLim	D/11			White-Green	
+ 24 V BRK & LIM	T/5			Yellow-Brown	Block A B
Shield	F/13			Shield	

NAME	**10: Foc/Rot Encoders - Topring**	PROJECT	F/35 Upgrade
DATE	20 DIC 99		
Connector	asmbly of shielded	LENGHT	0.80 m
FROM		TO	Back Terminals Strips
PLUG	Burndy 23 & 19 pins, Female, Chassis	PLUG	Terminals

SIGNAL	FROM pin		TO pin	WIRE COLOR or NUMBER	COMMENTS
Burndy 23 pin Chassis Fem					
FOCUS A +	Z			Violet	
A -	R			Black	
B +	S			White	
B -	T			Brown	
Z +	U			Gray	Block G
Z -	K			Pink	
Fault	H			Yellow	
+ 5 V	X			Red	
0 V	V			Blue	
Shield	L			White-Yellow	
Burndy 19 pin Chassis Fem					
ROTATOR A +	Z			Violet	
A -	R			Black	
B +	T			White	
B -	U			Brown	
Z +	W			Gray	Block H
Z-	X			Pink	
Fault	A			Yellow	
+ 5 V	H			Red	
0 V	K			Blue	
Shield	L			White-Yellow	

NAME	**11: ACROMAG**	PROJECT	F/35 Upgrade
DATE	18 JAN 2000		
Connector	asmbly of shielded	LENGHT	0.80 m
FROM	VME BackPlane Acromag P2	TO	LCU BackPlate, Auxiliary Board
PLUG	DIN 41612 welded	PLUG	DIN 41612, 2x Cannon D 25 & 9 pins

SIGNAL	FROM pin		TO pin	WIRE COLOR or NUMBER	COMMENTS
					Auxiliary Board DIN 41612 Upper
Focus Brake Status	A8		C11	Violet	
Rotator Brake Status	A7		C12	Black	
Focus Brake Ctrl	A15		C13	Red	
Rotator Brake Ctrl	A14		C14	Blue	
DAC A0	A13		C15	Gray	
DAC A1	A12		C16	Pink	
DAC CS	A11		C17	Yellow	
DAC R/W	A10		C18	Green	
DAC LDAC	A9		C19	Brown	
P(6,5)	A6		A25	White	
P(6,4)	A5		A26	Pink/Brown	
P(6,3)	A4		A27	Pink/White	
P(6,2)	A3		A28	Gray/Brown	
Chopper Position Ctrl	A2		A29	Gray/White	
P(4,3) Chopper DAC D11	C29		C21	Yellow/Brown	
P(4,2) D10	C30		C22	Yellow/White	
P(4,1) D9	C31		C23	Green/Brown	
P(4,0) D8	C32		C24	Green/White	
P(3,7) D7	A17		C25	Red/Blue	
P(3,6) D6	A18		C26	Gray/Pink	
P(3,5) D5	A19		C27	Gray/Yellow	
P(3,4) D4	A20		C28	Gray/Green	
P(3,3) D3	A21		C29	Black/Brown	
P(3,2) D2	A22		C30	Black/White	
P(3,1) D1	A23		C31	Blue/Brown	
P(3,0) D0	A24		C32	Blue/White	
GND	C16		C10	Brown/Red	

SIGNAL	FROM pin		TO pin	WIRE COLOR or NUMBER	COMMENTS
CHOPPER Power ON P(7,7)	A16		1	Gray	Cannon D 9 pin Female, L= 0.10m
(reserved) P(6,5)	A6		2	Yellow	
(reserved) P(6,4)	A5		3	Green	
(reserved) P(6,3)	B5		4	White	
GND	B6		9	Brown	
Shield	N.C.		5	Shield	
P(6,0) DICHROIC D8	A1		9		Cannon DB25 on distrib Panel
P(5,7) D7	C17		8		Thtough a 10 pin flat cable & conect.
P(5,6) D6	C18		7		
P(5,5) D5	C19		6		
P(5,4) D4	C20		5		
P(5,3) D3	C21		4		
P(5,2) D2	C22		3		
P(5,1) D1	C23		2		
P(5,0) D0	C24		1		
GND	C15		10		

NAME	**12: AUXILIARY**	PROJECT	**F/35 Upgrade**
DATE	**30 JAN 2000**		
Connector	**asmbly of shielded**	LENGHT	**0.80 m**
FROM	**VME BackPlane Auxiliary Board**	TO	**Terminal & Acromag**
PLUG	**2x DIN 41612 to solder**	PLUG	**DIN 41612, & bare wires w/ tags**

SIGNAL	FROM pin		TO pin	WIRE COLOR or NUMBER	COMMENTS
Upper Connector					Acromag Board DIN 41612 Upper
Focus Brake Status	C11		A8		P(6,7) R
Rotator Brake Status	C12		A7		P(6,6) R
Focus Brake Ctrl	C13		A15		P(7,6) W
Rotator Brake Ctrl	C14		A14		P(7,5) W
DAC A0	C15		A13		P(7,4) W
DAC A1	C16		A12		P(7,3) W
DAC CS	C17		A11		P(7,2) W
DAC R/W	C18		A10		P(7,1) W
DAC LDAC	C19		A9		P(7,0) W
P(4,3) Chopper DAC D11	C21		C29		P(4,3) W
P(4,2) D10	C22		C30		P(6,6) W
P(4,1) D9	C23		C31		P(6,7) W
P(4,0) D8	C24		C32		P(4,0) W
P(3,7) D7	C25		A17		P(3,7) W
P(3,6) D6	C26		A18		P(3,6) W
P(3,5) D5	C27		A19		P(3,5) W
P(3,4) D4	C28		A20		P(3,4) W
P(3,3) D3	C29		A21		P(3,3) W
P(3,2) D2	C30		A22		P(3,2) W
P(3,1) D1	C31		A23		P(3,1) W
P(3,0) D0	C32		A24		P(3,0) W
GND	C10		C16		
~~P(6,5)~~	~~A25~~		~~A6~~		~~P(6,5)~~
~~P(6,4)~~	~~A26~~		~~A5~~		~~P(6,4)~~
~~P(6,3)~~	~~A27~~		~~A4~~		~~P(6,3)~~
~~P(6,2)~~	~~A28~~		~~A3~~		~~P(6,2)~~
Chopper Position Softw. Ctrl	A29		A2		P(6,1) W

SIGNAL	FROM pin		TO pin	WIRE COLOR or NUMBER	COMMENTS
Chopper Position Extern Ctrl	A30				Insulated BNC on LCU BackPlate
Analog GND	A31				to BackPlate BNCs
DAC Analog OUT	A32				Insulated BNC on LCU BackPlate
+ 12 V	A20			Red	Blue
0 V	A9/A10			(not connected)	
- 12 V	A16			Yellow	Yellow
Lower Connector					Terminals Strip
FOCUS	~~C26~~			~~Violet~~	Handset Input : Not Used
P +	C25		*	Black	
MP	C22			Grey	
N +	C23		*	Blue	
MN	C20			Yellow	
GND	A1/C1			White-Grey	
GND	C18		*	Green	
					Block A
ROTATOR	~~C9~~			~~White~~	Handset Input : Not Used
P +	C8		*	Yellow-Brown	
MP	C5			White-Green	
N +	C6		*	Green-Brown	
MN	C3			Red-Blue	
~~Shield~~	~~A2~~		~~*~~	~~Shield~~	
FOCUS Brake Return	C21		*	Pink	
ROTATOR Brake Return	C4		*	Gray-Pink	
+ 24 V Brake & Limits	A10/A12		*	Brown	Block C
0 V	A18/C18		*	Grey	
+ 5 V	A14		*	Blue	

LCU Terminals Cabling

Power Supplies	Cable 9 Top-ring (Motor&Lim.		Terminal Strips	Cable 12 (lower) (Auxil. Board)	Cable 7 Maccon 2, Ch3 (Focus)	Cable 8 Maccon 2, Ch4 (Rotator)
			Focus P +	*black C25*	*brown C3*	
			MP	*grey C22*	*red C4*	
	pink A/8		**P -**		*blue C5*	
			N +	*blue C23*	*grey D3*	
			MN	*yellow C20*	*pink D4*	
	grey N/7		**N -**		*yellow D5*	
	grey-pink		**0 V**	*white-grey A1,C1*	*green C6*	*green C6*
	C/10		**0 V**	*green C18*	*green C7*	*green C7*
			Shield	*green-blue A2*		
			Shield	*green-blue*		
			Rotator P +	*yellow-brown C8*		*brown C3*
			MP	*white-green C5*		*red C4*
	white-green D/ 11		**P -**			*blue C5*
			N +	*brown-green C6*		*grey D3*
			MN	*red-blue C3*		*pink D4*
	brown-green E/12		**N -**			*yellow D5*
	red-blue U/6		**Focus Brake**	*pink C21*		
Power Supplies	*white-yellow B/9*		**Rotator Brake**	*pink/gray C4*		
orange	*yellow-brown T/5*	**C**	**+ 24V Brakes & Limits**	*brown A10/A12 orange*		
black			**0 V**	*gray A8/C8*		
blue			**+ 5 V**	*blue A14*		
	red V/1		**Focus M +**		*brownE7/E8*	
	blue P/2	**D**	**M -**		*white E5/E6*	
	violet J/6		**T +**		*brown E3*	
	black K/17		**T -**		*white E2*	

LCU Terminals Cabling

Cable 9 Top-ring (Motor&Lim.		Terminal Strips	Cable 12 (lower) (Auxil. Board)	Cable 7 Maccon 2, Ch3 (Focus)	Cable 8 Maccon 2, Ch4 (Rotator)
yellow-green F/13	E	Shield		*green-blue E4 green-blue*	*green-blue green-blue*
yellow S/4		ROTATOR M +			*brown E7/E8*
green R/3	F	M -			*white E5/E6*
(brown L/18)		T +			*brown E3*
(white M/19)		T -			*white E2*
violet Z		FOC. Encod A+	A & B swapped	*(B+) brown B7*	
black R		A -	to invert	*(B-) white B5*	
white S		B +	counting	*(A+) red A8*	
brown T		B -	direction	*(A-) blue A6*	
gray U	G	Z +		*pink A4*	
pink K	G	Z -		*gray A2*	
yellow H		Fault			
red X		+ 5 V		*yellow C2*	
blue V		0 V		*green C6*	
white-orange L		Shield		*Shield C6*	
white-orange L		Shield			*Shield C6*
violet Z		ROT. Encod A +			*red A8*
black R		A -			*blue A6*
white T		B +			*brown B7*
brown U	H	B -			*white B5*
gray W		Z +			*pink A4*
pink X		Z -			*gray A2*
yellow A		Fault			
red H		+ 5 V			*yellow C2*
Blue K		0 V			*green C6*
Cable 10 Top_Ring (Encoders)					